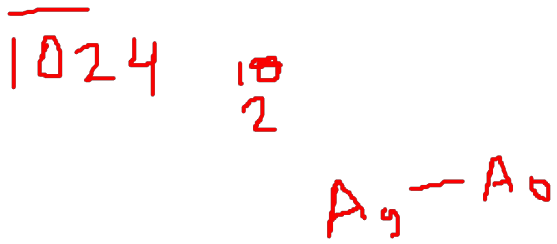
Design a big memory chip using small RAM and ROM chips

To construct a 512 B RAM chip four 128 B RAM chips are required.



Number of Address bits for small RAM chip = 7 ($A_6 - A_0$)
Number of Address bits for ROM chip = 9 ($A_8 - A_0$)

Memory Address Map

Component	Hexadecimal Address	Address bus A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
RAM 1	0000 – 007F	0	0	0	×	×	×	×	×	×	×
RAM 2	0080 – 00FF	0	0	1	×	×	×	×	×	×	×
RAM 3	0100 – 017F	0	1	0	×	×	×	×	×	×	×
RAM 4	0180 – 01FF	0	1	1	×	×	×	×	×	×	×
ROM	0200 – 03FF	1	×	×	×	×	×	×	×	×	×

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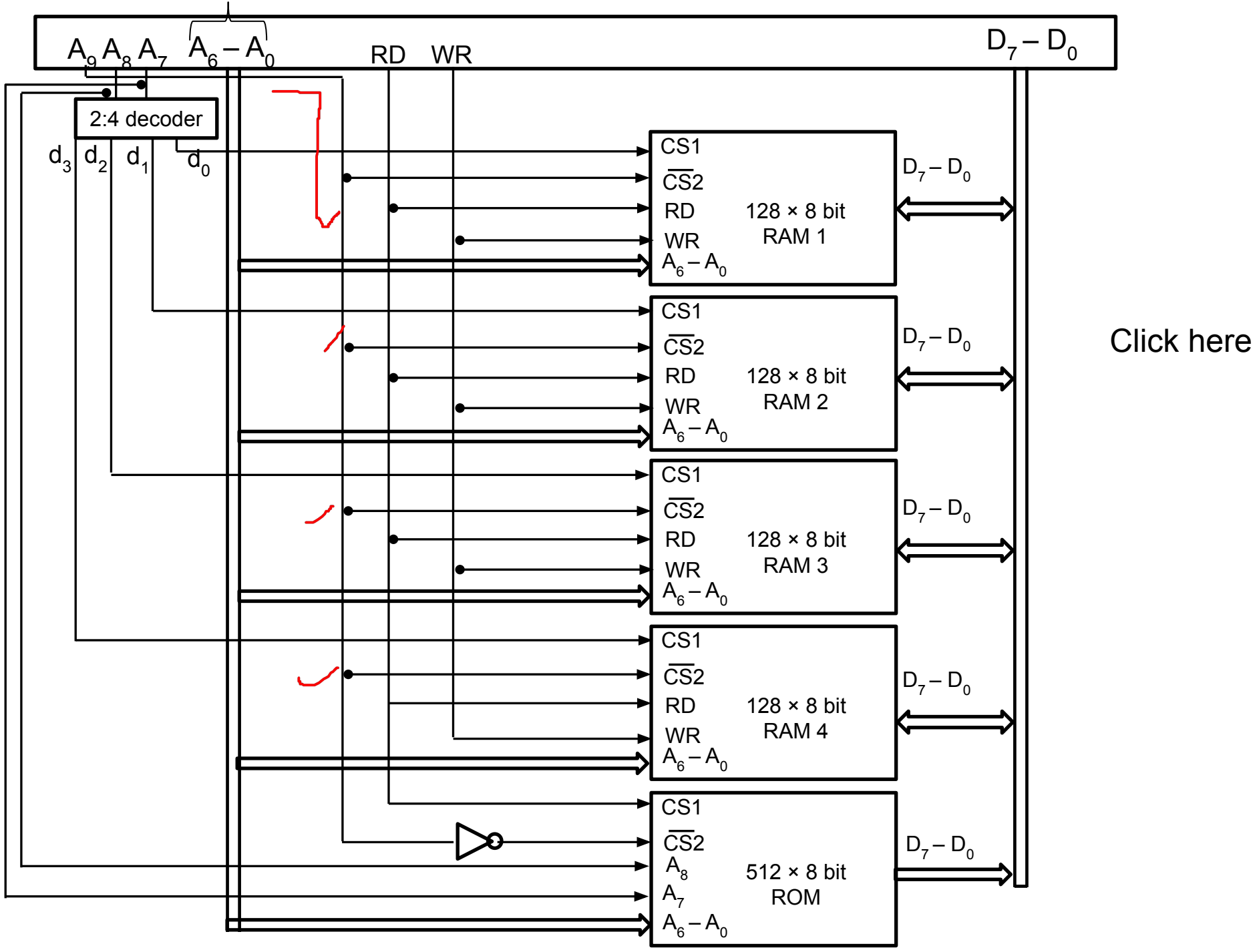
A_9 A_8 A_7
$A_6 - A_0$
RD
WR
$D_7 - D_0$
2:4 decoder
d_3 d_2 d_1 d_0
CS1
$\overline{CS2}$
RD
WR
$A_6 - A_0$
128 × 8 bit RAM 1
128 × 8 bit RAM 2
128 × 8 bit RAM 3
128 × 8 bit RAM 4
A_8
A_7
512 × 8 bit ROM

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Design a big RAM chip using small RAM chips where data bits are different

To construct a 64 K × 16 bit RAM chip How many 16KB RAM chips are required?

Big RAM chip size = 64 K × 16 bit
Available small RAM chip size = 16 K × 8 bit

Number of 16 KB RAM chips require =

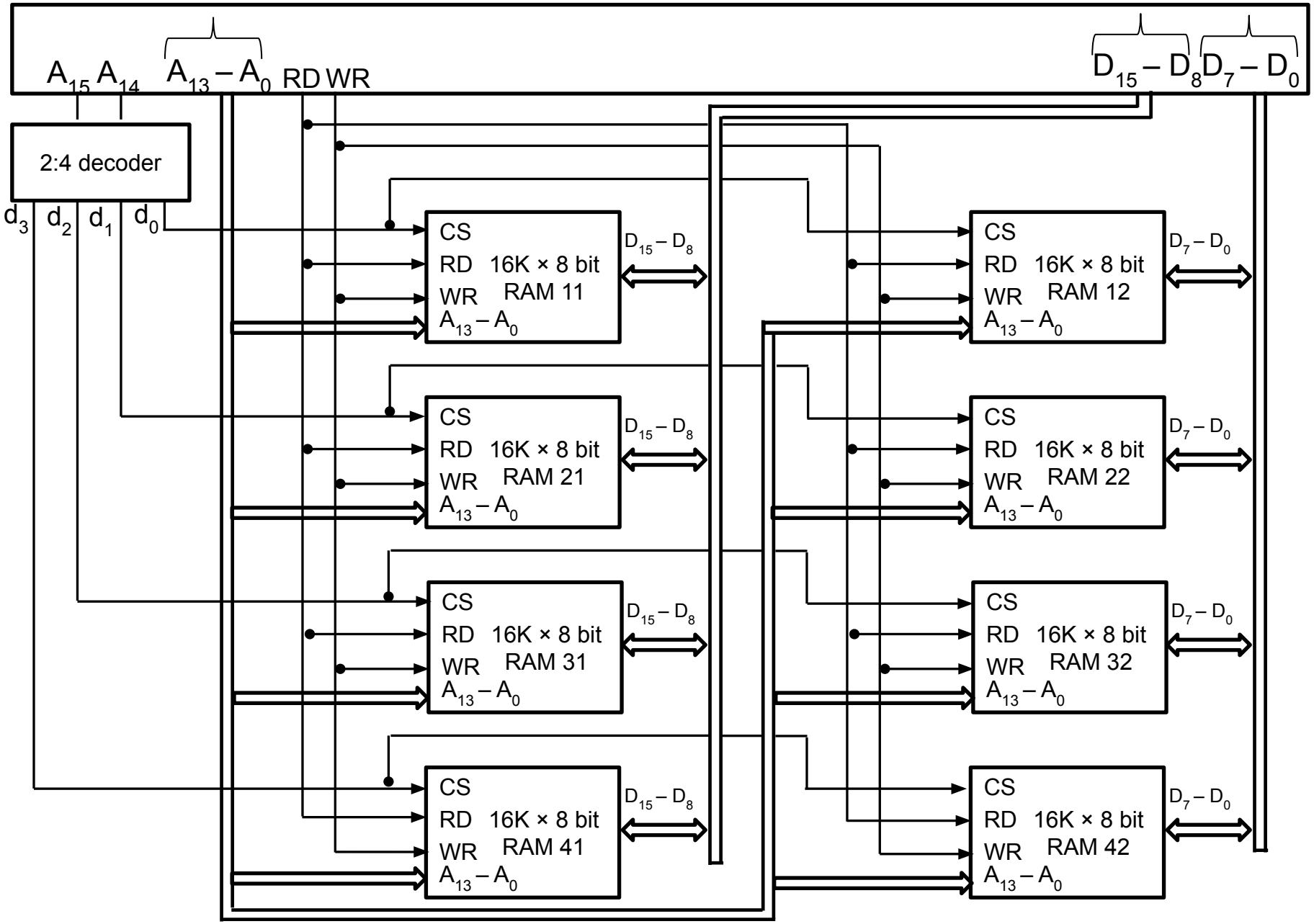
$$\frac{\text{Big RAM chip size}}{\text{Available small RAM chip size}}$$

$$\frac{64\text{ K} \times 16}{16\text{ K} \times 8}$$

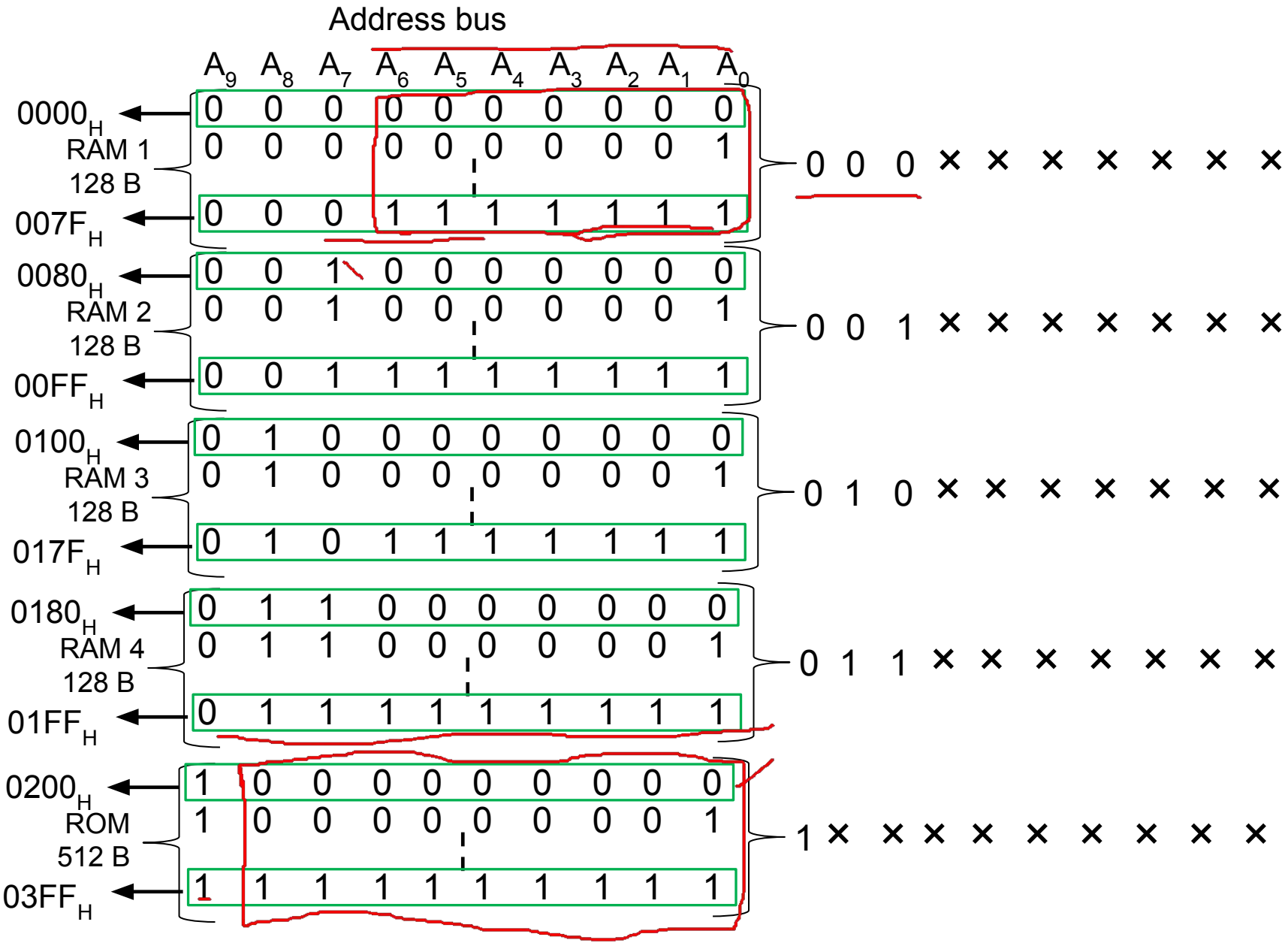
$$= 4 \times 2 = 8$$

Number of Address bits for small RAM chip = 14 ($A_{13} - A_0$)
Number of Address bits for big RAM chip = 16 ($A_{15} - A_0$)
Number of Data bits for small RAM chip = 8 ($D_7 - D_0$)
Number of Data bits for big RAM chip = 16 ($D_{15} - D_0$)

Memory connection



Thank You


Address bus
A9 A8 A7 A6 A5 A4 A3 A2 A1 A0
0000H
RAM 1
128 B
007FH
0080H
RAM 2
128 B
00FFH
0100H
RAM 3
128 B
017FH
0180H
RAM 4
128 B
01FFH
0200H
ROM
512 B
03FFH
0 0 0 × × × × × × ×
0 0 1 × × × × × × ×
0 1 0 × × × × × × ×
0 1 1 × × × × × × ×
1 × × × × × × × × ×
Back